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Part 1: Guidelines for image coding system evaluation

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Partie 1: Lignes directices pour l'évaluation des systèmes de codage d'image

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 29170 series can be found on the ISO website.

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Introduction

This document provides a framework and best practices to evaluate image compression algorithms. This document provides a selection of evaluation tools that allow testing multiple features, including objective metric image quality, subjective metric image quality and codec algorithmic complexity. Which features of codecs should be tested and pass-fail criteria is beyond the scope of this document.

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Information technology — Advanced image coding and evaluation —

Part 1:
Guidelines for image coding system evaluation

1 Scope

This document recommends best practices for coding system evaluation of images and image sequences. This document defines a common vocabulary of terms for coding system evaluation and divides evaluation methods into three broad categories:

a) subjective assessment;

b) objective assessment;

c) computational assessment.

In addition to these broad assessment categories, this document discusses special care that is given for coding unusual imagery, e.g. high dynamic range or high colour depth.

A fourth assessment category, hardware complexity, is often important for real-time or computationally complex applications; however, it is outside the scope of this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
channel
one logical component of an image

Note 1 to entry: A channel may be a direct representation of one component from the bitstream, or may be generated by the application of a palette to a component from the bitstream.

[SOURCE: ISO/IEC 15444-1:2016, 3.17 – modified to move part of definition into a Note to entry]

3.2
codec
coding system
system comprising a *compressor* (3.6), a *decompressor* (3.8) and the compressor's bitstream output is compatible with the decompressor's bitstream input

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3.3
component
two-dimensional array of samples

Note 1 to entry: An image typically consists of several components, for instance, representing red, green, and blue.

[SOURCE: ISO/IEC 15444-1:2016, 3.26 – modified to move part of definition into a Note to entry]

3.4
component bit depth
number of bits of precision of colour channels (or components) of an unencoded image

3.5
component number
number of colour channels (or components) encoded in an image

3.6
compressor
portion of a coding system that has a pixel stream and may have control metadata as its input and a coded bitstream as its output

3.7
constant bit rate
mode where the number of encoded bits from a portion of an image represented by a fixed number of *pixels* (3.16) does not vary compared to the number of encoded bits in any other equally sized portion of the same image

3.8
decompressor
portion of a *codec (coding system)* (3.2) that has a coded bitstream as its input and a *pixel* (3.16) stream as its output

3.9
drift
net generational loss of image quality if the output of a lossy image compression/reconstruction cycle is recompressed again under the same conditions by the same *codec* (3.2)

3.10
expert observer
observer that has expertise in image artefacts that may be introduced by the system under test or who has designed or participated in the selection of test content for the system under test

3.11
generational quality loss
measure of *quality loss* (3.17) between a reference image and a reconstruction of the same image after repetitive generations of encoding and decoding

3.12
horizontal pixel resolution
horizontal extent of the image in image *pixels* (3.16) where the horizontal extent may depend on the channel

3.13
idempotent
codec (3.2) that operates losslessly on its own decompression output

3.14
non-expert observer
naïve observer
observer that has no expertise in the image artefacts that may be introduced by the system under test

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3.15
objective assessment
computational algorithmic process leading to a numerical score for all or a portion of an image under test

3.16
pixel
smallest element that is capable of generating the full intended functionality, e.g. colour and grey scale, of the display

Note 1 to entry: In a multicolour display, the smallest addressable element capable of producing the full colour range or the smallest element that is capable of generating the full functionality of the display.

3.17
quality loss
measure of the difference between a reference image and an encoded and reconstructed representation of the same image

3.18
sample
one unit of a grey scale or colour where an unencoded image comprises a plurality of these units

3.19
sample precision
bit depth of a given data type encoding the image

3.20
sample type
type of numeric value that contains *sample* (3.18) values to a resolution specified by *sample precision* (3.19) where types can include unsigned integers, signed integers and floating point or fixed point samples

3.21
sub-sample
sample (3.18) where the number of samples in either the horizontal dimension or the vertical dimension is not equal to the horizontal or vertical image dimension, respectively

3.22
subjective assessment
algorithmic process where recorded observations from human subjects (observers) lead to a numerical score for all or a portion of an image under test

3.23
variable bit rate
mode where the number of encoded bits in a portion of an image represented by a fixed number of *pixels* (3.16) can be different from the number of encoded bits in any other equally sized portion of the same image

3.24
vertical pixel resolution
vertical extent of the image in *pixels* (3.16) and the vertical extent may depend on the channel for subsampled images

4 Abbreviated terms

bpp	bits per pixel
CIE	International Commission on Illumination
CIEDE2000	CIE colour difference formula

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